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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 November 2002 (14.11.2002)

PCT

(10) International Publication Number
WO 02/091652 A2

(51) International Patent Classification[7]: H04L

(21) International Application Number: PCT/US02/08469

(22) International Filing Date: 19 March 2002 (19.03.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/277,593	20 March 2001 (20.03.2001)	US
60/277,767	20 March 2001 (20.03.2001)	US
60/277,451	20 March 2001 (20.03.2001)	US
60/277,592	20 March 2001 (20.03.2001)	US
60/285,419	20 April 2001 (20.04.2001)	US
09/912,587	24 July 2001 (24.07.2001)	US

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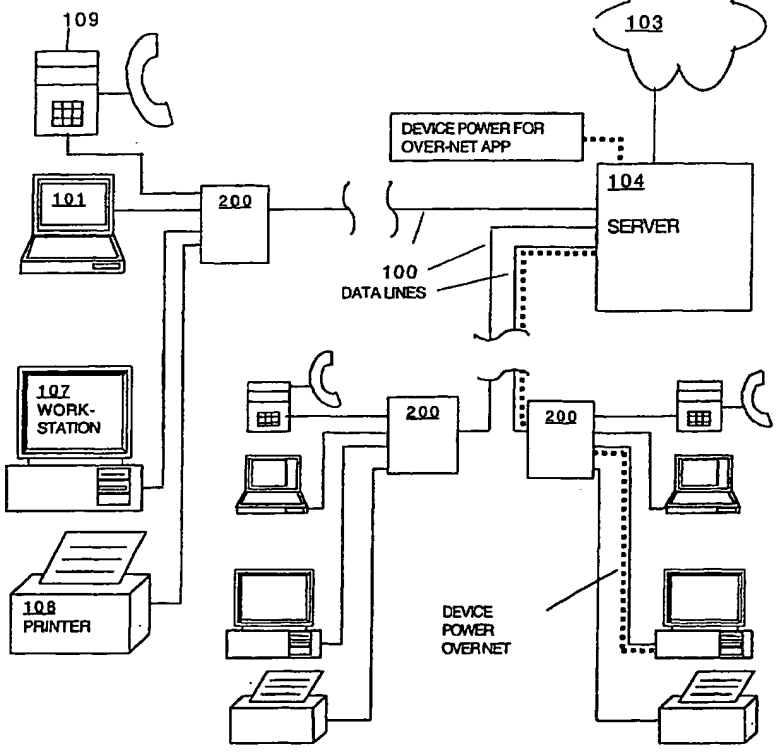
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: INTELLIGENT CONCENTRATOR



(57) Abstract: The present invention relates to an apparatus for multiplexing signals in a network. The apparatus has a housing which contains two or more network connection devices along with suitable intelligent electronic circuitry for controlling and multiplexing data, voice telephone signals, and power for multiple devices connected to the connection devices. The multiplexing enables the various devices to communicate with the network and, in some cases, to receive power over the network connection. The intelligent electronic circuitry is also capable of aiding in network security and management. A primary advantage of the disclosed invention is an enormous reduction in the network cabling required for a new network installation and a near elimination of the need to install new cabling for modification of an existing network.

WO 02/091652 A2

European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTELLIGENT CONCENTRATOR

RELATED U.S. APPLICATIONS

This application claims priority to the commonly-owned co-pending provisional patent applications: patent application U.S. serial number 60/277,593, entitled "'INTELLIJACK' PHYSICAL CONCEPTS," filed March 20, 2001, and assigned to the assignee of the present invention; patent application U.S. serial number 60/277,767, entitled "A METHOD FOR MANAGING INTELLIGENT HARDWARE FOR ACCESS TO VOICE AND DATA NETWORKS," filed March 20, 2001, and assigned to the assignee of the present invention; patent application U.S. serial number 60/277,451, entitled "A METHOD FOR FILTERING ACCESS TO VOICE AND DATA NETWORKS BY USE OF INTELLIGENT HARDWARE," filed March 20, 2001, and assigned to the assignee of the present invention; patent application U.S. serial number 60/277,592, "'INTELLIJACK' USAGE," filed March 20, 2001, and assigned to the assignee of the present invention; and patent application U.S. serial number 60/285,419, "INTELLIGENT CONCENTRATOR," filed April 20, 2001, and assigned to the assignee of the present invention.

FIELD OF THE INVENTION

The present invention relates to the field of Local Area Networking (LAN). More specifically, the present invention relates to a device and system for efficiently multiplexing data, voice, FAX and power lines between the work site and the network.

BACKGROUND OF THE INVENTION

Modern Local Area Networking (LAN) is generally accomplished by extensive runs of multiple parallel cables to multiple connections and devices at each work site. This is in addition to voice telephone, FAX, and device power cabling. When LAN infrastructures require change, it is generally more efficient to leave existing cables in place and simply string new cables between switch and router nodes and any new work site devices.

The current state of the art for implementing data multiplexing and Firewall technology, on a per user basis, is centered around providing the capability in a centralized head end data switch or router or by distributing these functions to the end user's location by placing a box level data concentrator switch and security equipment, whether hardware firewall, access control or

hardware encryption device, next to the computing equipment that is to be connected to a data LAN.

Current distributed solutions are ad hoc, of questionable reliability, inefficiently managed and subject to failures caused by accidental removal of power and wire breakage. Current solutions require local power which adds an installation requirement and reduces system reliability. Security could be breached through intentional or inadvertent bypassing of any installed Firewall. Software solutions are hard to deploy and maintain in the field and once installed are subject to attacks through common hacking techniques. An additional weakness of software solutions is that the device that is to be networked may not be able to host the required software.

What is needed, then, is a means of reliably multiplexing voice, data, FAX and power lines in order to reduce the cost of installation and infrastructure change in a LAN. Furthermore, such a means should provide information about usage and should facilitate the management and security of the network.

SUMMARY OF THE INVENTION

Presented herein is an intelligent local area network connection jack that provides a means of reliably multiplexing voice, data, FAX and power lines in order to reduce the cost of installation and infrastructure change in a LAN. Furthermore, the connection jack provides information about usage and facilitates the management and security of the network.

The present invention relates to an apparatus for multiplexing signals in a network The apparatus has a housing which contains two or more network connection devices along with suitable intelligent electronic circuitry for controlling and multiplexing data, voice telephone signals, and power for multiple devices connected to the connection devices. The multiplexing enables the various devices to communicate with the network and, in some cases, to receive power over the network connection. The intelligent electronic circuitry is also capable of aiding in network security and management. A primary advantage of the disclosed invention is an enormous reduction in the network cabling required for a new network installation and a near elimination of the need to install new cabling for modification of an existing network.

Embodiments of the present invention disclose an apparatus for multiplexing signals in a network. The apparatus comprises a housing, two or more network connection devices coupled with the housing, and intelligent electronic circuitry, coupled with the housing and communicatively coupled with network connection devices; wherein the intelligent electronic circuitry is adapted to control the multiplexing of signals and power in the network cabling connected to the network connection devices.

BRIEF DESCRIPTION OF THE DRAWINGS

The operation of this invention can be best visualized by reference to the drawings.

Figure 1 (Prior art) illustrates a conventional LAN implemented with a server and work centers.

Figure 2A illustrates a LAN, configured in accordance with one embodiment of the present invention.

Figure 2B illustrates a variation on a LAN equipped with embodiments of the present invention.

FIGURE 3 illustrates a block diagram of an exemplary connection of an intelligent connection apparatus in accordance with one embodiment of the present invention.

Figure 4 illustrates a possible configuration for one embodiment of the present invention.

The drawings referred to in this description should be understood as not being drawn to scale except if specifically noted.

BEST MODE FOR CARRYING OUT THE INVENTION

Reference would now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, and circuits have not been described in detail so as not to unnecessarily obscure aspects of the present invention.

Some portions of the detailed descriptions that follow are presented in terms of procedures, logic blocks, processing, and other symbolic representations of operations on signals within an electronic circuit. These descriptions and representations are the

means used by those skilled in the electronic arts to most effectively convey the substance of their work to others skilled in the art. A procedure, logic block, process, etc., is here, and generally, conceived to be a self-consistent sequence of steps or instructions leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated in an electronic system.

There are many conceivable embodiments of the present invention. However, the concepts underlying the present invention may be best understood by the discussion of only a few embodiments. This discussion in no way limits the application of the concepts nor determines the limit to embodiments possible.

This embodiment of the present invention implements intelligent hardware that is easy to install and reliably provides an attachment point for access to Voice & Data Networks. The embodiment is implemented through miniaturized hardware that could be installed inside a wall or in an internal space provided for in an office cubicle. One surface of this embodiment is intended to

be accessible by the end user and would in most instances be on an external surface of a workspace.

In one embodiment, several standard communications jacks, such as RJ45, as well as status indicator lights, are mounted on the external, user accessible, surface of the embodiment. One intended implementation provides for four RJ-45 communication jacks. However, alternative implementations could support a greater or lesser number.

Connections to the central data network (LAN) or voice telephone network (or perhaps dedicated FAX lines) in the present embodiment would be terminated at the connection apparatus. These connections would be established by an installer and would not be intended to be accessible by the end user. In most instances, the wiring between the unit and the communications infrastructure would terminate inside the wall or possibly office cubicle fixture. Termination of the network wiring (voice or data) would provide for both a reliable electrical and mechanical connection for industry standard communications cabling such as CAT3, CAT5 or CAT5E or similar cabling. A variation of the implementation could also similarly accommodate fiber-optic cabling. It is envisioned that the integrity of the installation may utilize mounting hardware such as

screws or snap fit techniques that could not removed by an end user without specialized tools.

In addition to terminating data connections, this embodiment of the present invention could support digital telephone connections, such as those entailed by VOIP (Voice Over Internet Protocol) technology. In the intended implementation, an RJ-45 connector or other modular connector could be configured to provide either a LAN data connection or a digital telephone connection. The end user would be able to insert a data cable or a telephone into the jack and either device would be supported. The end user would not have to actively configure or program this embodiment to enable either mode of operation.

Support for a separate direct termination of a cable to a separate sub-net could also be provided. The ability to directly terminate a line to another data or voice line would provide for the ability to accommodate growth for new data and voice technologies that may not be compatible with the capabilities of this embodiment of the present invention. Such flexibility may be desirable to support new network topologies as well.

In addition to wired connections to and from this embodiment and the client devices, wireless connectivity could also be viable. Standard communication media such as IR, BlueTooth, 802.11 or other means could be utilized to communicate with the device.

Power for this embodiment as well as devices connected to it could be provided from a central source over the network cabling. This embodiment would also be able to forward power to data devices that are connected to the communications jacks that are on the user accessible surface. The power that is provided could be connected in a manner that would isolate the effect of electrical faults due to component failures or shorts in the connected device or the wires to it. Such isolation could prevent a failure that is external to this embodiment from damaging it and would isolate the failure in a way that would allow this embodiment itself and devices that are connected to the unit to remain operational. Recovery of the effected port would be automatic and could occur as soon as the failed device or wire is removed. This embodiment would implement this feature with current limiting fold back circuitry. An alternative implementation could be through self-healing "Poly Switch" fuses but current limiting is the preferred

implementation since it would allow the embedded intelligence to sense the condition and report it to a central management console.

The benefits that accrue from the physical mounting of the device in the manner already described would add significantly to the functionality, reliability and the range of functions that could be performed by this embodiment. Installations that do not provide for the termination of the wiring to the network internal to a protected surface such as a wall or a cubicle are inherently unreliable and are subject to a degrading of connections from mechanical stress, abrasion and related mechanisms. The placement of attachment points in a protected environment would eliminate problems from accidental stresses that could occur. Mechanical stress could occur if a user were to snare a device cable and inadvertently pulled on the embodiment, either directly or through the attached cable. The mounting hardware would isolate the forces to which the wiring is subjected.

Another benefit of the physical attributes of this embodiment that has been described is that the end user does not have direct access to the network infrastructure. This embodiment of the present invention itself could serve as a managed access control point. If this embodiment was established in another manner such

as a stand alone box, the end user might be able to circumvent the functions performed by this embodiment and could gain direct, unmanaged, access to the network. It is apparent that concepts presented in this embodiment of the present invention provide an added degree of security by presenting a controlled point of access.

For wireless connectivity, an antenna or an IR port could be built into the face of the implemented unit itself. The antenna could also be constructed to allow it to be implemented on or above the surface. The electronics suite contained within the housing in this embodiment could provide the additional supporting circuitry to implement a wireless connection.

Another significant advantage offered by this embodiment is the provision of a degree of directionality that could be optimized to limit the number of devices, both intended and unintended, with which any unit would be able to communicate. By employing directionality and shielding, the occupant of a workspace would be able to reliably communicate with the unit while another person in an adjacent space using similar equipment would be less likely to interfere with or even gain access to the first user's communication.

It is envisioned that the unit could be produced as separate elements. The base unit would contain the capability to terminate the cabling while a separate unit containing the intelligent electronics could be added to the base unit at a later time. The functional split of the unit in this manner would allow for wide deployment of network wiring infrastructure in a cost effective manner since the cost of the intelligence would not be borne for work areas that might not currently be occupied. Other benefits that derive from this type of functional partitioning is in the area of field service and upgrades. A unit that was suspected to have failed could quickly be replaced and retested. Also, newer units with added capabilities could be added where needed and older modules could still be used in areas where the added capabilities were not needed.

It is also envisioned that a modular expansion capability could be added onto the base unit to enable the functions of the deployed units to be readily adopted to new and varying needs. The expansion module would mate onto the faceplate and would obtain bus signal and power from it. Serial buses such as USB or Ethernet could be suitable for this purpose. The implementation of a modular add-on could be implemented in a fashion so the end user would not view the bus expansion connector as a general purpose interface as would

be the case with a PC. This would be done to avoid problems that could arise if end users inserted cables directly into industry standard expansion connectors, expecting to enable the functions provided by a peripheral device. This limiting of supported capabilities is anticipated since the on-board intelligence could not be assumed to have the capability to detect the characteristics of the inserted device. There also would not necessarily be an easy means to add the required software elements nor a user interface to support the level of communications with an end user that some peripheral require.

It is also envisioned that some implementations of this embodiment of the present invention might be as plug-in add-ons that could securely mount over existing data communications jacks. An alternative mounting technique for this embodiment would be to allow the unit to mount over and plug into the existing communication jacks.

The wall mounted units could provide for additional capabilities such as data concentration, security, VOIP support, etc. However, to achieve the real benefits of the added reliability and security similar to what was described for in wall mounting the attachment needs to be implemented in a manner that enables for a

quick and easy installation while providing for a capture mechanism that is not releasable by the end user.

A further understanding of the concepts presented in this discussion of this embodiment of the present invention may be had by reference to the attached Figures.

Prior art Figure 1 illustrates a conventional LAN implemented with a server and three work centers. A work center might be populated with a workstation 107, a network printer 108, a laptop 101 or other devices and combinations of devices that require direct communication with the server in order to function properly. Additionally, a voice telephone, 109, using Voice Over Internet Protocol (VOIP) technology might be in the modern workplace. Each of these devices requires a cable connection to the server or to its peripheral switching mechanisms. As discussed earlier, each of these connections currently requires a separate cable run which can be very expensive and can compromise system integrity and security.

Figure 2A illustrates a LAN, configured with the same equipment as in Figure 1, where the work area equipment has been connected to the network via embodiments of the present invention, which can be called smart network portals or intelligent

concentrators, 200. All of the same functions and devices of the previous work centers are represented but, using intelligent concentrators, a single cable is all that is required to connect the work area equipment suite with the server. VOIP telephone 109 is implemented as well in the equipment array.

Also illustrated in Figure 2A is one implementation of device power over the network connection. This could be implemented for devices whose power requirements were low enough to make such a multiplexed power supply system cost effective. A high power requirement could drive the cable sizes too large to make any cost savings be attainable.

Figure 2B illustrates a variation on the LAN equipped with intelligent concentrators. Here, a further reduction in cabling cost is gained by the use of a "daisy-chained" arrangement of intelligent concentrators. A daisy-chain would result in only one cable being connected directly to the server, or to its peripheral switching center, to connect a plurality of work centers.

Figure 3 illustrates a possible configuration for an embodiment of the present invention. Intelligent concentrator 301 is shown in side cutaway view, with connector jacks 304 and

wireless device 307 shown in one of several conceivable arrangements. Wireless communication device 307 is envisioned as being enabled in a variety of protocols. Infrared and Bluetooth, or some other RF implementation, are possibilities. Multiplexing of signals to and from server 104 would very likely be under the control of in-unit electronics 302. Again, those signals and possible power for some devices, would travel over single cable 100 and connect to intelligent concentrator 301 via back-of-unit connector 306.

Also shown in Figure 3 is add-on device 303. A range of possibilities exists for the functions of device 303. It could be implemented as an intelligent remote testing device, allowing the network infrastructure and cabling to be tested and evaluated from a central location, without any action being required at the work site. Device 303 might also be implemented as a security device, preventing physical attachment to the LAN cabling without a notification being sent to the server that the physical network port has been compromised.

Figure 4 illustrates a possible configuration for an embodiment of the present invention. Intelligent concentrator 301 is shown here with four RJ-45 jacks, 304. There is space, even if an embodiment takes the form factor of a standard wall plate device, for more jacks, 308. These other jacks could enable a parallel

connection to a different network or to a telephone system or to a number of other envisioned possibilities. Figure 4 also shows status indicator light 305 which could be implemented in a possible embodiment.

Also shown in Figure 4 is wireless communication device 307. Device 307 could be implemented in any number of wireless standards for non contact connection to the network. Again, infrared or an RF protocol, such as Bluetooth, are possible communication standards that come to mind. The necessary transceiver electronics for device 307 are likely to be contained in the body of concentrator 301, possibly integral with internal electronics 302.

As a summary; this description has disclosed the present invention relates to an apparatus for multiplexing signals in a network. The apparatus has a housing which contains two or more network connection devices along with suitable intelligent electronic circuitry for controlling and multiplexing data, voice telephone signals, and power for multiple devices connected to the connection devices. The multiplexing enables the various devices to communicate with the network and, in some cases, to receive power over the network connection. The intelligent electronic circuitry is also capable of aiding in network security and management. A primary advantage of the disclosed invention is an enormous reduction in the network cabling required for a new network installation and a near elimination of the need to install new cabling for modification of an existing network.

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the Claims appended hereto and their equivalents.

CLAIMS

We claim:

1. An apparatus for multiplexing signals at a work center in a network, comprising:

a work center mountable housing;

two or more network connection devices coupled with said work center mountable housing; and,

electronic circuitry, coupled with said work center mountable housing and communicatively coupled with said network connection devices; wherein:

said electronic circuitry is enabled to control the multiplexing of said signals in network cabling connected to said network connection devices, such that multiplexing of signals emanating from said work center and demultiplexing of network signals intended for said work center are accomplished locally at said work center.

2. An apparatus as described in Claim 1 wherein said network connection devices are capable of connecting data lines.

3. An apparatus as described in Claim 1 wherein said network connection devices are capable of connecting voice telephone lines.

4. An apparatus as described in Claim 1 wherein said network connection devices are capable of connecting dedicated FAX lines.

5. An apparatus as described in Claim 1 wherein said network connection devices are capable of connecting to and delivering device power.

6. An apparatus as described in Claim 1 wherein said electronic circuitry is capable of communicating system information to said network.

7. An apparatus as described in Claim 1 wherein said electronic circuitry is further enabled to assist maintenance of network security.

8. A method for connecting devices to a network at a work center, comprising the steps of:

a) providing a device connector at said work center capable of connecting network devices to a network;

b) connecting two or more network devices to said device connector; and,

c) multiplexing signals between said network and said network devices.

9. The method described in Claim 8, wherein said step of providing a device connector is accomplished with a modular cable connector.

10. The method described in Claim 8, wherein said step of multiplexing signals is capable of multiplexing network data signals.

11. The method described in Claim 8, wherein said step of multiplexing signals is capable of multiplexing voice telephone signals.

12. The method described in Claim 8, wherein said step of multiplexing signals is accomplished at said work center.

13. The method described in Claim 8, wherein said network connection devices are capable of connecting dedicated FAX lines.

14. The method described in Claim 8, wherein said network connection devices are capable of connecting to and delivering device power.

15. The method described in Claim 8, wherein said electronic circuitry is capable of communicating system information to said network.

16. A system for connecting a network, comprising:

a network comprising one or more servers and one or more work centers;

cabling communicatively connecting said work centers and said servers in said network; and,

one or more connecting devices enabled to intelligently multiplex communication between a plurality of devices in said work centers and said network.

17. The system described in Claim 16, wherein said work centers comprise desktop computers.

18. The system described in Claim 16, wherein said work centers comprise printers.

19. The system described in Claim 16, wherein said work centers comprise VOIP enabled telephones.

20. The system described in Claim 16, wherein said connecting devices are enabled to connect to other connecting devices in a daisy-chain fashion.

21. The system described in Claim 16, wherein said connecting devices comprise circuitry enabled to assist in maintaining the security of said network.

22. The system described in Claim 16, wherein said connecting devices comprise circuitry enabled to assist in managing the infrastructure of said network.

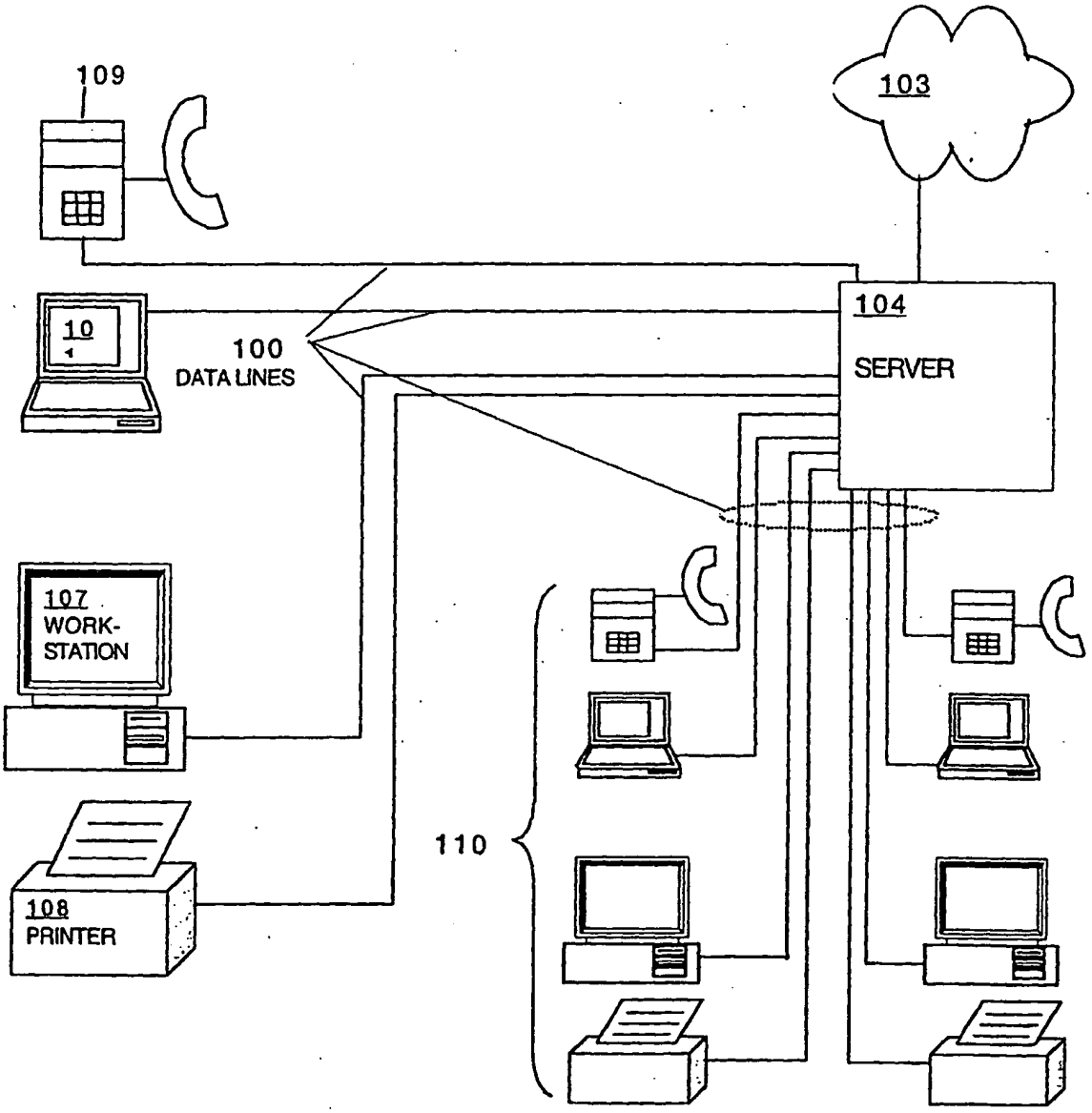


FIGURE 1
(PRIOR ART)

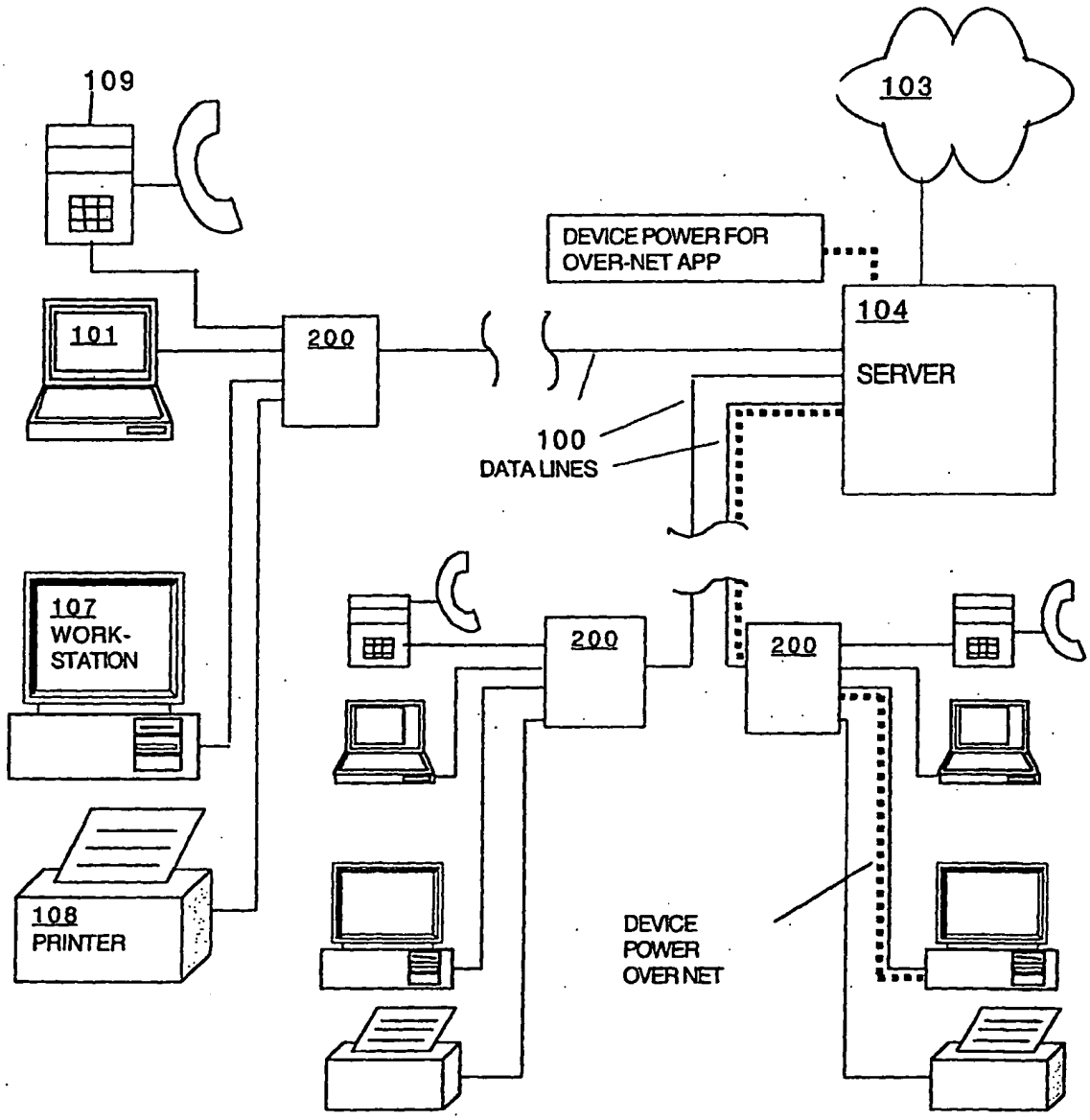

109
103
DEVICE POWER FOR OVER-NET APP
101
200
104
SERVER
100
DATA LINES
107
WORK-
STATION
200
200
108
PRINTER
DEVICE
POWER
OVER NET

FIGURE 2A

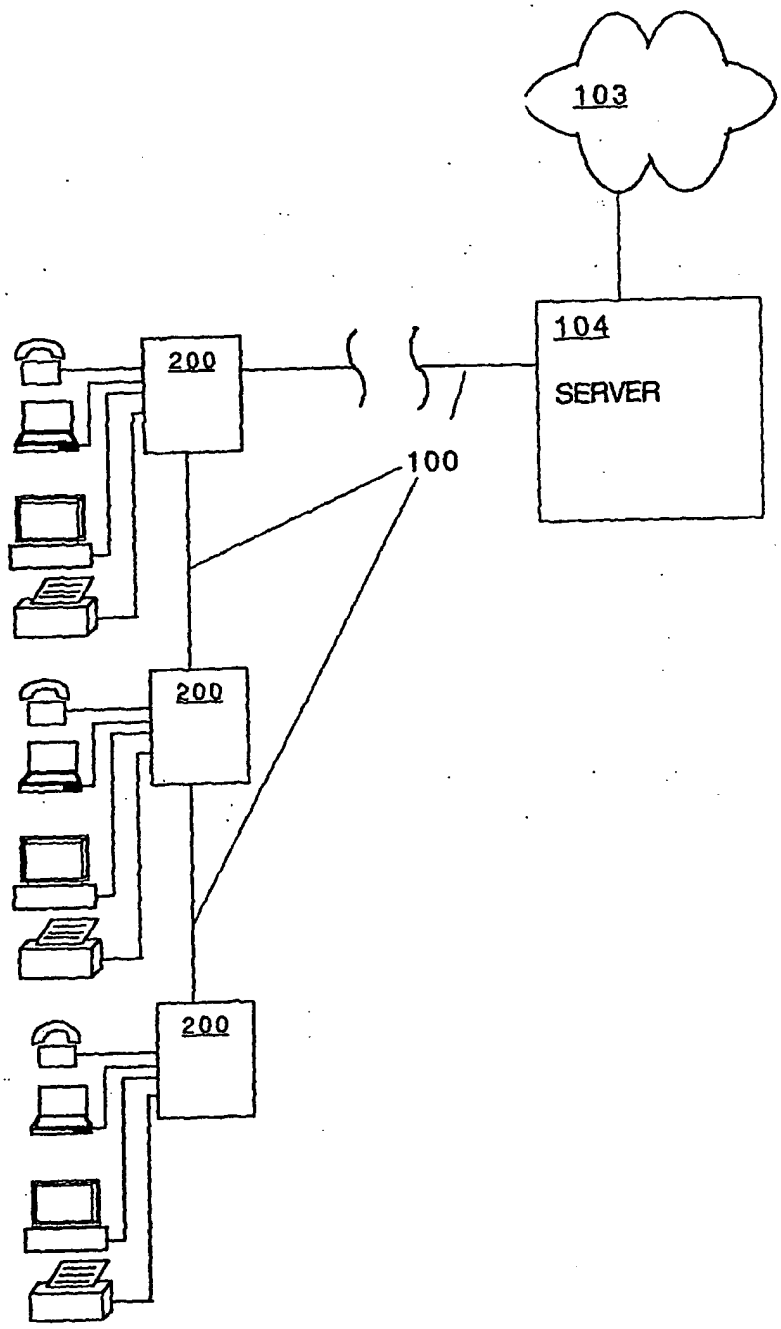


FIGURE 2B

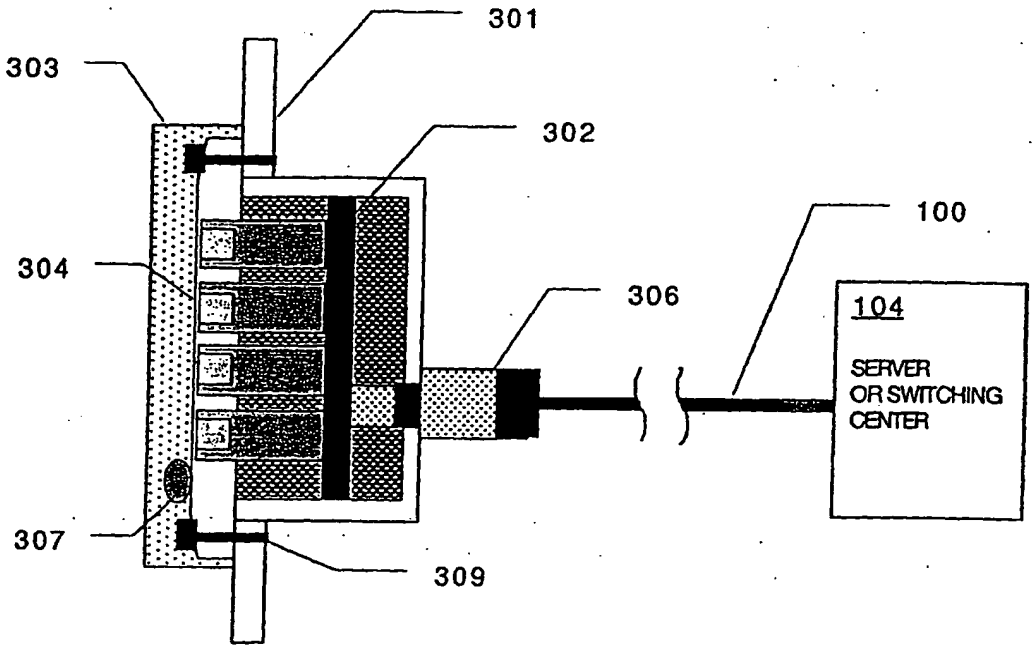

301
303
302
100
304
306
104
SERVER
OR SWITCHING
CENTER
307
309

FIGURE 3

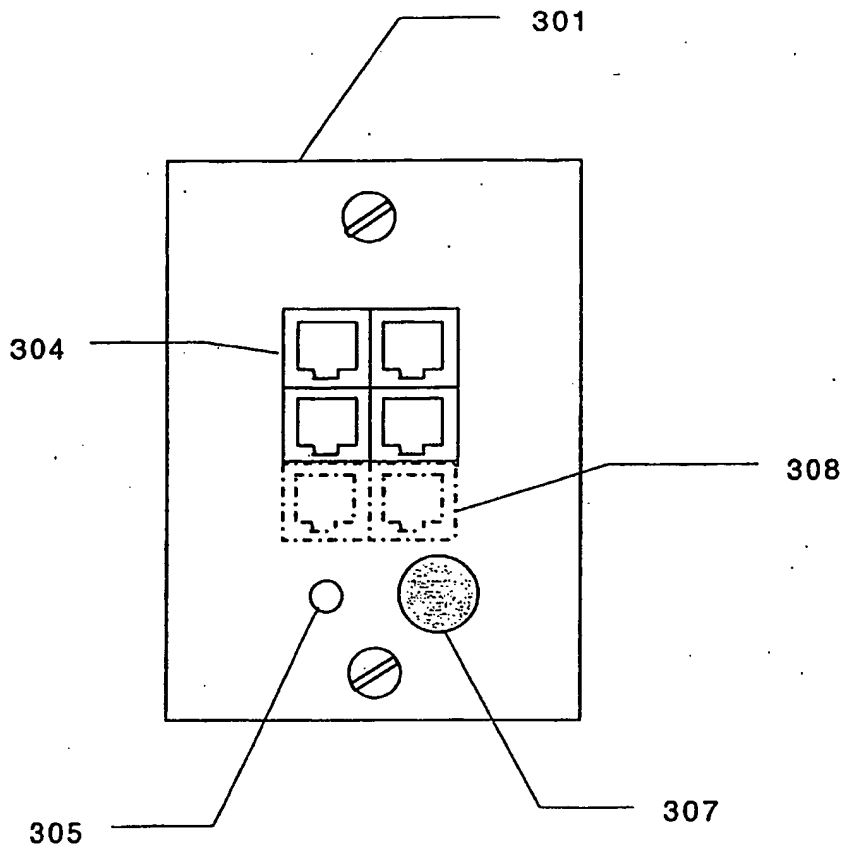


FIGURE 4